

Survival Stressors Faced by Military Aviators/Aircrew Following Ditching Over Salt Water

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ABSTRACT

Helicopter ditching scenarios over salt water present an intense and immediate array of stressors for aviators and aircrew members. These initial stressors are further exacerbated by survival stressors, which ensue following safe egress from the ditched air vehicle. The scope of this paper encompasses a study of both planned and un-planned survivable ditching scenarios with respect to military rotary-wing applications. In order to gain a more complete understanding of the stresses involved following ditching over salt water, three phases will be discussed: initial ditching, underwater egress and water survival.

An accumulation of stressors from the initial ditching phase, to the underwater egress situation, to salt-water survival can quickly lead to distress, or may enhance one's will to survive, depending on the mindset relied upon. Bolstering the will to survive in a salt-water environment following a helicopter ditching requires comfort in the water and confidence of self, gained via a structured training regime. Training allows for practical experience and educates aviators/aircrew on the psychological affects one may anticipate in a given water survival scenario.

INTRODUCTION

Every year, several ditching mishaps occur in both civil and military

aviation affecting fixed and rotary-wing applications. The United States Coast Guard (USCG) reports that, "on the average, there's a ditching once a day in the continental United States...most of these are precipitated by instances such as fuel shortage, persistent engine or cabin fire, engine failure, flight-control problem(s), or pilot error, to name a few [1]." While a number of ditching related incidences affect general aviation aircraft, the scope of this paper intends to study both planned and un-planned survivable ditching scenarios with respect to military rotary-wing applications.

Helicopter ditching scenarios over salt water present an intense and immediate array of stressors for aviators and aircrew members. Initial stressors are further exacerbated by survival stressors that ensue following safe egress from the ditched air vehicle [2]. In order to gain a more complete understanding of the stresses involved following ditching over salt water, three phases will be discussed: initial ditching, underwater egress and water survival. The primary discussion of stressors will center on the water survival episode; however, it is important to understand the ditching event in its entirety.

DITCHING

A ditching encompasses three distinct phases. The initial or ditching phase involves recognition of the fact that an emergency situation is imminent,

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preparation and planning for a safe ditching and the actual ditching. The secondary phase is coined the egress phase. This period, initiated following the cessation of all forward motion and inrushing water, involves crewmember egress from the downed aircraft. The final stage, the survival phase, begins following safe egress and concludes with rescue [3].

It has been acknowledged that aviators and “aircrew...usually receive little or no warning of an impending crash [4].” Typical warning times of looming water ditchings vary from less than 15 seconds to 1 minute; however, crews who may be considered “lucky” have had more advanced notice in the past. In most cases, the crew responds to the air vehicle in attempts to either correct a harmful situation or avoid the ditching or directs their efforts to flying the ill-fated bird into the water in the safest manner possible.

The limited time prior to water immersion is typically considered stressful. In cases where the crew is aware of the forthcoming water-ditching event, every attempt must be made to remain as calm as possible, and preparation for impact is key. To avoid injury, the crew must be securely restrained and be in proper position for crash impact (the proper position depends on the type of restraint used). Individuals equipped only with lap belt restraints should lean forward as far possible by bending at the waist and should place their head face down between their knees. The feet should be “firmly planted on the floor, arms folded beneath the knees, and chest tight against the upper thighs [5].” Crewmembers equipped with shoulder and lap restraints should tighten

restraints, sit as erect as possible and brace for impact.

Upon water impact in a ditching scenario, the helicopter, which is unstable in water, will react violently as the turning rotor blades contact the water. In a study conducted by Boeing Vertol of 200 Navy Marine helicopter ditching in 1976, it was noted that, “the fuselage often rocked from side to side and the fuselage sometimes would spin on its vertical axis like an unwinding gyro...as rotor rpm decayed and aircraft control was lost, the helicopter typically rolled inverted left or right, breaking or bending the rotor blades [4].” Helicopters typically float upright, float inverted or sink inverted following a ditching. The latter two scenarios are most likely, more common and most devastating with respect to loss of life. In fact, it has been noted that, “ninety percent of those who drown are involved in a ditching in which the aircraft becomes inverted in the water [6].” The aforementioned study also noted that “the (200) helicopters all reacted similarly on ditching – more than 50% sank in less than 1 minute, all non-amphibious craft capsized before or during submergence, and almost all that sank did so nose first [4].” Ryack, Luria and Smith support this finding by noting that, “within a minute – even in as few as 20 seconds – the helicopter will often begin to sink to a depth from which no one can survive [7].”

Given the above predicament, one can easily distinguish inherent dangers concerning impact, the sink rate and the initial ditching phase as a whole, as well as imagine the instantaneous and immense stress that conscious aircrew would likely be under.

UNDERWATER EGRESS

The second phase of the ditching process involves underwater egress from the ditched air vehicle. Water is considered a hostile environment and escape from a crashed helicopter in such a setting can be complicated, tedious and stressful. Several potential life-threatening conditions can hinder safe egress following submersion in salt-water, including airframe distortion impeding access to escape hatches and dislodged equipment causing injury to personnel or obstructing access to egress routes [8].

“The most critical problem involving helicopter underwater escape is the inability of aircrew members and passengers to escape from the aircraft following submersion [9].” In an article addressing aviation safety and underwater egress training, Bill Cristobal refers to the fact that “more than two-thirds of those who perish die because they could not get out of the

sinking aircraft, not from being injured in the ditching itself [6].”

A five-year study (Calendar Year 1979-1983, Table 1) conducted by the Naval Safety Center confirmed 70 fatalities resulting from 65 helicopter landings or crashes into the water. A vast majority of the fatalities were attributed to submersion related causes, such as drowning or underwater entrapment in the helicopter. (The case of being lost at sea is also included in submersion related deaths.)

A significant difference in the survival rate at night versus the rate occurring during daylight hours is noted. It is hypothesized “that the darkness of night adds to the confusion and disorientation of the crew and passengers leading to their entrapment while the aircraft is sinking [9].”

Table 1. Helicopter Water Escape Cumulative 1982-1986 [9]

Type	Total Mishaps		Total Occupants		Total Fatalities		Survival Rate	
	Day	Night	Day	Night	Day	Night	Day	Night
AH-1	1	1	2	2	2	1	0%	50%
UH-1	4	1	17	3	-	3	100%	0%
H-2	8	8	32	28	1	9	97%	68%
H-3	8	8	35	34	-	1	100%	97%
H-46	8	3	52	25	14	19	73%	24%
H-53	6	-	44	-	30	-	32%	-
H-57	-	-	-	-	-	-	-	-
H-60	2	1	7	3	2	-	71%	100%
Totals	37	22	189	95	49	33	74%	65%

An earlier statement indicated that the egress phase is initiated following the cessation of all forward motion and intrushing water, involving crewmember egress from the downed aircraft. Immediately following water impact, survivors are faced with physical and mental challenges, and are subjected to a number of stressors that are not found in the aviator/aircrew member's normal environment, that of land [10]. Survivors typically have difficulty with underwater egress following a ditching scenario. "Of those who survive a ditching, only 8% manage to escape the aircraft without difficulty [6]." The primary obstacles that the survivor must contend with and conquer in hopes of maintaining survival status are intrushing water, disorientation and breath-holding ability. Survivors must not only cope with the stressors presented during underwater immersion (including but not limited to intrushing water, disorientation, and breath-holding ability), they must also deal with stressors accumulated during the previously occurring ditching phase.

Given the case in which an aircraft sinks immediately, Naval aviators and aircrew members are trained to delay egress activities until all intrushing water and forward motion ceases and the aircraft is completely submerged; otherwise they are to follow abandonment procedures as outlined in the aircraft Naval Air Training and Operating Procedures Standardization (NATOPS) manuals [5]. Proper training is significant in preparing an individual for an extreme event, and will briefly be discussed later.

Inrushing water presents a severe dilemma for survivors. Individuals who were unable to completely strap-in prior to ditching may be washed away from

exits by the turbulent water, or the force of the water may thrust the individuals into dangerous objects leading to further injury or potential death. One pilot survivor described the sensation of intrushing water as comparable to "being hit in the chest by a fire hose [4]". Intrushing water has several serious effects on the survivor, all of which may lead to potential drowning.

Brooks has noted four particular effects relative to intrushing water, the primary effect being panic. Panic, an overwhelming feeling of fear and anxiety, is a typical human reaction in this scenario, given that the aircrew is exposed to the potential of drowning. Brooks notes that panic "can only be prevented by good, repeated, realistic training."

Uncontrolled hyperventilation, an uninhibited and abnormally fast or deep respiration, resulting in the loss of carbon dioxide from the blood, may occur in response to the stress of the situation. This may, in turn, reduce breath-holding ability thereby adding further to the stress that one is under. In addition, buffeting (repeated beating or striking) in the seat will likely occur while intrushing water dominates. This effect can lead to intense disorientation, which will be briefly addressed in the following paragraph. Finally, while the scope of this paper does not review temperature dependant waters, it is essential to note an additional effect of intrushing water, that of immersion in cold water. "If the water is below 10 C and the survivor is not wearing a protective suit, the chances of drowning is enhanced through a combination of events, panic, hyperventilation, reduced breath-holding ability, and the development of a cardiac arrest or arrhythmia [4]."

Disorientation is noted as the second major setback following inrushing water. “The rotation of the body underwater and loss of gravitational references makes disorientation inevitable for survivors prior to escape from an inverted sunken helicopter. In conjunction with darkness, which contributes to disorientation, it is the second biggest problem after in-rushing water [4].” The following case accounts for disorientation in an underwater egress scenario.

“The crew of a USN H-3 Sea King helicopter were conducting an automatic coupled approach to a sonar hover when the master caution light was illuminated, followed by a steady transmission oil pressure caution light. The helicopter made an emergency water landing, rolled, inverted and sank. Upon hitting water, the pilot released his lap belt and inrushing water pushed him from his seat. He immediately became disoriented. He felt a seat, groped for a window, and exited through the co-pilot’s window. The co-pilot had released his lap belt and exited feet first through his sliding window after removing his helmet. After all forward motion ceased, the crewman released himself and exited through the left sonar window just as the helicopter began to roll. The report noted that the pilot and co-pilot had not had helicopter underwater escape training [4].”

This example describes the effects of inrushing water and cites disorientation as an issue during egress. The example also demonstrates the need for Naval aviators to have appropriate underwater egress training to assist in emergency situations.

Finally, breath-holding ability can present additional stress for

aviators/aircrew, and can define the difference between life and death. “It is impossible to accurately predict the time required to make a successful underwater escape from a ditched, inverted helicopter [11].” In an attempt to capture an ideal time in a controlled environment, Brooks, Muir and Gibbs note that, “in ideal conditions of warm water in the simulator, the individual exit time is dependent on seating position, learned skills, and breath-holding ability. It averages 10 seconds for a pilot next to the cockpit window, and 1-20 seconds for a passenger to complete an aisle seat evacuation, depending on the window position and complexity of the jettison mechanism [for escape hatches]. These individual escape times are consistent worldwide [12].”

Breath-holding ability is based on individual capacity; some have the ability to breath-hold for longer periods of time than others. Breath-holding can be affected by fear, panic, possible uncontrollable hyperventilation and by an individual’s response to stress (under stressful conditions, one may be short of breath, and another may be able to breath-hold for a longer period of time depending on personal motivation). To date, Naval aviators/aircrew members (rotary-wing) are equipped with Helicopter Aircrew Breathing Devices (HABD bottles) to allow for extended time to egress when in an underwater survival situation. According to O’Rourke, an Engineering Technician providing engineering cognizance over personal survival equipment for the Navy, a number of individuals involved in underwater egress scenarios have found the presence of the HABD bottle comforting, momentarily relieving the instantaneous rush of panic [13].

In addition to intruding water, disorientation and breath-holding ability, a number of other challenges threaten survival. "In 1975, the Naval Air Systems Command asked the Naval Submarine Medical Research Laboratory to determine exactly what difficulties were encountered in trying to escape from a submerged helicopter and to develop methods to overcome them. Interviews with survivors of such crashes and a review of relevant reports confirmed that most passengers and crew members survive the crash, but may be unable to release their seat-belts; and if they do, the confusion and disorientation resulting from intruding water, poor visibility, and darkness often prevents them from finding the escape hatches [7]."

Difficulty releasing restraints has been noted as an area of concern. Some accounts attribute the difficulty to primacy and reverting to learned tasks, such as attempting to release a vehicle seatbelt before taking a few seconds to assess the situation and properly releasing the aircraft restraint; others refer to panic numbing the mind and not allowing logical action to dominate. In addition to restraint difficulties, common experiences among survivors of mishaps involving water ditching and submersion are panic, disorientation, difficulty locating and reaching escape hatches, jammed hatches, entanglement, intruding water, and darkness [9,14].

Although a general aviation mishap, the following account exemplifies the common experiences that occur in underwater egress scenarios (military accident reports and accounts are more sensitive and availability is limited, thus the general aviation account in this case).

"Following an engine failure, the Piper Super Cub that I had been flying wound up inverted in the water. My first instinct was to attempt pounding out a window, but water resistance prevented me from developing sufficient force. Panic began to set in, and I felt pain developing in my chest as I resisted the natural and almost overwhelming urge to inhale. After conceding that this might be the end of my life, the thought finally occurred to open the door. I did and found myself standing in 5 feet of water. The panic caused by suddenly discovering myself inverted and underwater in an airplane had numbed my mind and delayed logical action almost until it would have been too late [15]."

Again, panic and difficulty with egress are noted in this example. The underwater egress phase of ditching presents several challenges for the survivor. While the stress level at this point is based on the individual, one can ascertain that the overall stress level is at least moderate if not notably higher for conscious survivors.

WATER SURVIVAL

The third phase of the ditching process is that of water survival. Having experienced water impact and successful underwater egress, the survivor must next tackle survival in a salt-water environment.

"A key ingredient in any survival situation is the mental attitude of the individuals involved. Having survival skills is important; having the will to survive is essential. The soldier in a survival environment faces many stresses that ultimately impact his mind. These stresses can produce thoughts and

emotions that, if poorly understood, can transform a confident, well-trained soldier into an indecisive, ineffective individual with questionable ability to survive...Perhaps the most difficult survival situation to be in is sea survival [16].”

Potential stresses and stressors faced by the survivor in a salt-water environment are explored in the following pages. A discussion of stress and stressors is provided, followed by a more in-depth investigation of typical survival related stressors and natural reactions to said stressors.

Stress

Stress, described as the human reaction to a given form of pressure, is a condition that all experience, it is not a disease that can be cured or eliminated. Stress is the title given to physical, mental, emotional and spiritual responses to tensions experienced in daily life. Stress is individual. That is, what is highly stressful for one may not be stressful for another. Personal experiences, beliefs, motivation, physical and mental conditioning, training, and level of self-confidence are among the contributors to what one finds stressful [17].

Stress is necessary, and can provide numerous positive benefits. Stress presents challenges, allows one to learn about individual strengths and values, demonstrates one’s ability to handle pressure without breaking, tests flexibility and adaptability, and can stimulate individuals to perform tasks at peak levels.

While stress can be beneficial, it can also be detrimental. Distress produces uncomfortable tension and is caused by an abundance of stress, more

than an individual can conceivably tolerate. Those suffering from distress typically display behaviors such as difficulty making decisions, angry outbursts, low energy level, propensity for mistakes and carelessness, to name a few.

Stress, therefore, can be encouraging or discouraging, constructive or destructive. “Stress can inspire you to operate successfully and perform at your maximum efficiency in a survival situation. It can also cause you to panic and forget all your training. Key to your survival training is your ability to manage the inevitable stresses you will encounter. The survivor is the soldier who works with his stresses instead of letting his stresses work on him [16].”

Survival Stressors

Stressors are events that produce stress; stressors are the cause and stress is the response. When the body recognizes a stressor, it shifts into “fight or flee” mode and prepares to protect itself. Internal changes take place in response to stressors; “the body releases stored fuels (sugar and fat) to provide quick energy; breathing rate increases to supply more oxygen to the blood; muscle tension increases to prepare for action; blood clotting mechanisms are activated to reduce bleeding from cuts; senses become more acute (hearing becomes more sensitive, eyes become big, smell becomes sharper) so that you are more aware of your surrounding and heart rate and blood pressure rise to provide more blood to the muscles. This protective posture lets a person cope with potential dangers, however, a person cannot maintain such a level of alertness indefinitely [16].”

The body has a limited ability to resist stress and as stressors accumulate an eventual state of exhaustion will occur. It is in this instance that the positive affects of stress depart and distress dominates. To effectively manage stress, one must anticipate the stressors and develop a plan of action to cope with the situation. Doing so in a simulated survival situation may help tremendously when an actual survival situation is encountered. Basic knowledge of the types of stressors associated with survival is essential for aviators/aircrew members flying over open water.

That being said, a number of survival stressors, known as the enemies of survival are explored below. Although the list is not conclusive due to such factors as individual differences among personalities, situations, environmental factors, political climates and pilot/aircrew reasoning and decision-making, general survival stressors are evaluated.

Injury, Illness, or Death

Survivors may be subjected to injury, illness and death, all of which act as stressors in a survival situation. Perhaps an injury sustained during the ditching scenario or underwater egress event limits an individual's abilities to maneuver, defend and aid in the survival of oneself, requiring help of another survivor, or worse being a weakened sole survivor. An illness prior to the event or stemming from the water survival episode, may degrade one's abilities or will to survive and may act as an additional stressor. Pain and discomfort resulting from injury or illness can act as another stressful mechanism. Coping with the death of

comrades or foreseeing potential death of oneself is yet another avenue for stress that can affect one's mental, physical or psychological state. "It is only by controlling the stress associated with the vulnerability to injury, illness, and death that a soldier can have the courage to take the risks associated with survival tasks [16]."

Uncertainty and Lack of Control

Adding to the stresses of being ill, injured, or potentially killed is stress resulting from uncertainty and the obvious lack of control in a water survival situation. Some individuals feel the need to be in control of the situation at all times and for these people, the lack of control can translate into an extreme stressor. Uncertainty of rescue, how long one will be stranded, who may spot the survivor(s) (such as a potential enemy), threats located in the immediate vicinity (sharks, poisonous animals/plants, dangerous fuels/toxins), the changing sea state, weather and uncertainty of one's own survival are a sampling of the countless measures of concern that may cause substantial stress for survivors. According to the U.S. Army Survival Field Manual, "the only guarantee in a survival situation is that nothing is guaranteed [16]." Limited information and limited control can prove to be major stressors in a water survival situation.

Environment

The salt-water environment can be terrifying for individuals involved in water ditching and survival scenarios. Contending with the stressors of varying sea states, wind patterns and weather patterns including rain, thunder, lighting,

snow, ice, and extreme heat and cold, along with a number of other environmentally related conditions, could be difficult for the survivor. As previously mentioned, additional stressors such as dealing with insects, dangerous animals, floating debris and contaminants can increase overall stress levels. The individual who is comfortable in the salt-water environment may or may not experience stressors to the same degree as those who view salt-water as an uncomfortable environment [16].

Hunger and Thirst

In the water survival scenario, one must be careful to not swallow too much salt water. Ingestion of large amounts of salt water can lead to illness and eventual dehydration. In extended sea survival states, one must conserve and drink as much freshwater as possible. Without water, one will weaken and eventually perish. Obtaining and preserving food in a water survival state can be exceedingly stressful, should the need arise in an extended survival scenario. Hunger “lessens an individual’s ability for rational thought and increases susceptibility to the weakening effects of cold, pain, and fear [18].” Hunger and thirst can act as additional stressors in the extended water survival situation.

Fatigue

Fatigue is dangerous; it can decrease mental ability and can be considered a significant stressor. In response to fatigue one can become careless and motivation can weaken. Survival situations can last for minutes,

hours or days, and forcing oneself to continue to survive and remain awake or conscious can be exhausting and severely fatiguing, thus, establishing yet another survival stressor.

Isolation

Relying on oneself or being the sole survivor can be an intense stressor. “Perhaps nothing is more stressful than being alone in an unfamiliar environment where you could die from hostile action (or) an accident [16].” Ditching into salt-water can place a survivor in a desolate environment in which one can see only water with no land in sight. Being alone can be dangerous for the individual both physically and mentally. In the military, each soldier/sailor is taught individual strengths, but is also taught to work as a team. During military training, a great deal of time is allocated to teamwork and being part of a functioning team. Without a team present, the individual must rely solely on his own means, which can be an extraordinary stressor. Human contact provides a sense of security (although perhaps a false sense of security, it may serve as a bearer of hope) and the notion that another individual or group of individuals is available if necessary. Human beings are typically social animals, by nature, and contact with others is seemingly essential, especially in times of need. Isolation can be considered a fundamental stressor in water survival [16].

Recognizing general stressors and responding to and managing stressors, thereby allowing them to work with and for oneself as opposed to against oneself, is key. The stressors

described above can add to the stresses experienced during ditching and underwater egress. A combination of stressors can lead to distress, which can lead to diminished morale among the survivor(s).

In addition to the general stressors previously discussed, further stressors exist in helicopter ditching scenarios over salt water. Water survival scenarios are typically difficult and stressful. When one is able to board a life raft, a few stressors may be slightly reduced; however, depending on the individual, this may not be the case. An individual submerged from the neck down in water may have more or different stressors affecting them than the survivor who has a primitive form of shelter such as that of an individual life raft. It is important to note that, "it is a simple fact that deployment of an internally carried life raft from an inverted submerged helicopter is virtually impossible [4]." According to Mergard, an Equipment Specialist who provides engineering cognizance for all aviation inflatables in the Navy, at the time of this paper, "the U. S. Navy (USN) has deployed a very small number of multi-place (multiple person) life rafts from a ditched helicopter [19]." While equipped with life rafts, a minimal record of incidence of use following a ditching scenario has been noted, reportedly due to lack of convenient access to the system, given the time and crash constraints. The survivor is concerned primarily with safely egressing the submerged fuselage, not with searching for a heavy life raft, therefore endangering his chances of survival. Survivors without a life raft may experience lower morale than those with a life raft. Environmental stressors and fatigue related stressors might have

more of an affect or impact on the survivor lacking a life raft. Although evidence is not available to support either conclusion at this time, it could be presumed that a difference in stressors may likely be evident for the individual without the support of a life raft.

A number of survival stressors were discussed with respect to salt-water survival; however, the list cannot be considered conclusive due to previously mentioned constraints (personal stressors, different situations). General water survival stressors include, but are not limited to: injury, illness or death, uncertainty and lack of control, the environment, hunger and thirst, fatigue, isolation and life raft availability. The following segment will assess natural human reactions to the abovementioned survival stressors.

NATURAL REACTIONS

"Psychologic reactions to survival stresses often render the individual incapable of using available resources. A most significant psychologic requirement for survival is the ability to immediately accept the reality of the new situation and react appropriately to it [18]

Natural reactions to previously mentioned water survival stressors and the ability (or inability) to adapt physically and mentally can either be of benefit or of consequence in a water survival situation. In a survival situation, psychological reactions to stressors are expected. A number of the major internal reactions to survival stressors are examined.

Fear

Fear is an emotional response to an unsafe physical, emotional or mental

situation that presents the potential to lead to injury, illness or death. Fear can provide positive encouragement by supporting cautious behavior in an environment in which mistakes are costly. The positive function of fear is also that of applying one's fear to the situation and not allowing one's fear to consume him. By being cerebral, one is able to calm down, thus quieting fear, thereby typically straying away from panic. Conquering one's fears typically improves morale overall. Fear can also lead to negative reinforcement depending on the personal level of threat one foresees. An individual can allow fear to control him, rendering a person immobile and 'frozen', unable to perform necessary survival procedures or actions. Some degree of fear is anticipated in an unfamiliar, foreign territory. How one chooses to deal with that fear can mean the difference between life and death. That is, managing one's fears is key in a successful water survival scenario [16].

Anxiety

Anxiety is closely associated with fear; fear is natural, as is anxiety. Fear is the source of anxiety. Anxiety can be considered a state of uneasiness and apprehension about a future event. In the water survival case, anxiety is that feeling experienced with respect to an unsafe physical, emotional or mental situation in the given unpredictable salt-water environment. Again, anxiety can be used in a healthy approach or have a negative impact on a survival situation. Anxiety can be reduced by methodically performing activities that can serve as a means to an end, such as performing activities to assist in one's own survival. On the other hand, anxiety utilized in a

negative manner can lead to confusion and difficulty in thinking clearly. Distress has its way with the individual if one is not able to control one's level of anxiety or fear [16].

Anger and Frustration

Frustration occurs in response to one's difficulty or inability to reach a specific goal. The primary goal of water survival is to remain alive long enough to reach help or until help is able to gain access to the survivor. With life in the balance, frustration levels can run high, considering when a potential for mistakes exists, an abundance of errors typically occur. Anger is a product of frustration. Frustration and anger characteristically go hand in hand. The weather, damaged survival gear, lack of a life raft, enemy patrols, and one's own physical limitations are examples of potential sources of frustration and anger in a water survival scenario. Anger and frustration are typically associated with negative behaviors. The two feelings can lead to a notable decrease in motivation to survive and eventually lead to an 'I quit' attitude if not controlled properly. In addition, the emotional responses can encourage impulsive reactions and irrational behavior as well as poorly developed solutions to issues. Alternatively, anger and frustration, if harnessed, can indeed be converted into positive energy, which can be channeled to other resources to further chances of survival [16].

Depression

Feelings of extreme sadness, guilt, helplessness and hopelessness are coined depression. When faced with a water survival scenario, it would be rare

to find an individual who did not show signs of sadness. Frustration and anger bridge depression. Anger and frustration rally in a destructive manner until an individual becomes exhausted physically, mentally or emotionally. Resistance to depression is crucial. Temporarily thinking about loved ones in a weak moment can become a catalyst for survival. Conversely, if depression prevails, energy levels can sink and the will to survive can ultimately degrade [16].

Loneliness and Boredom

As noted previously, the human being is a social animal; individuals typically enjoy the company of others. Only a limited number of individuals feel the need to constantly be alone. In loneliness, one can learn the value of one's time and discover hidden abilities, inner strengths and talents. In this case, self-sufficiency is vital. On the other hand, loneliness and boredom can act as an additional source of depression, again stemming from frustration and anger [16].

Guilt

Guilt is an emotional response noted frequently in survival situations. Being one of few or the sole survival in a ditching scenario can have a severe impact on the feelings of the remaining aircrew [20]. Alleviation sets in once it becomes apparent that one is indeed alive. Conversely, one tends to mourn the loss of comrades and is apt to feel guilty for surviving while others proved less fortunate. "This feeling, when used in a positive way, has encouraged people to try harder to survive with the belief they were allowed to live for some

greater purpose in life. Sometimes, survivors tried to stay alive so that they could carry on the work of those killed [16]." Guilt, although a natural, anticipated reaction should not be the survivor's primary focus. Guilt should not prevent a survivor from living or wanting to live.

Natural reactions to stressors presented in the water survival scenario can have beneficial or grave effects on the outcome of the survival scenario. According to both United Kingdom and United States statistics, "88% of controlled ditchings are successful, but approximately 50% of survivors die after safely exiting the aircraft, but before rescue arrives (Flight Logistics, 2004)." This could be due to a number of factors, such as succumbing to water survival stressors, severe injuries sustained during ditching or underwater egress, time delay in rescue, poor weather or visibility for search and rescue vehicles and swimmers, decayed will to survive, or post egress drowning. The list of potential causes is seemingly limitless.

CONCLUSIONS

In the survival situation, one encounters numerous stressors that can potentially impede a successful rescue if not handled in an appropriate manner. An accumulation of stressors from the initial ditching phase, to the underwater egress situation, to salt-water survival can easily lead to distress, or can enhance one's will to survive, depending on the mindset relied upon. According to Anderson, "there may be a delayed emotional reaction ranging from manic elation to agitated depression [22]" in a survival scenario. The ultimate reaction can assist or impede the survival process.

Anderson also reminds the reader that, “the word *survive* comes from the Latin super...above, beyond...and vivo...I live. Practice it. Your brain is your best survival weapon. Use it. Think. Improvise [22].” He continues to assert that in a survival scenario, “determination and spiritual confidence are as important as physical strength [22]”. This agrees with a previous statement the Survival Field Manual, “a key ingredient in any survival situation is the mental attitude of the individuals involved. Having survival skills is important; having the will to survive is essential [16].”

Bolstering the will to survive in a salt-water environment following a helicopter ditching requires comfort in the water and confidence of self, gained via a structured training regime. Training allows for practical experience and educates aviators/aircrew on the psychological affects one may anticipate in a given water survival scenario. “Occupants of a ditched aircraft with egress training stand a 250% better chance of surviving than untrained crew or passengers [6].”

The Survival Field Manual presents guidelines to assist in preparing oneself psychologically for survival. These are to “know yourself, anticipate fears, be realistic, adopt a positive attitude, remind yourself what is at stake, train and learn stress management techniques [16].” Perhaps this advice, together with training, knowledge of survival stressors and one’s natural reactions to stress, in addition to the importance of the will to survive or the refusal to give up, can assist one in a salt-water survival situation following a controlled or uncontrolled survivable helicopter ditching.

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BIOGRAPHY

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